

New data regarding the geographical distribution of *Pseudochazara graeca* in Greece, with notes about its wing coloration, the status of its ssp. *coutsisi* (= *zagoriensis*), as well as the supposed correlation between the HW underside ground colour and the geological character of the habitat in both *P. graeca* and *Hyponephele lycaon* (Lepidoptera: Nymphalidae, Satyrinae)

Hristos T. Anastassiou, John G. Coutsis & Nikos Ghavalas

Abstract. Several colonies of *Pseudochazara graeca* (Staudinger, 1870) are reported for the first time from north-central Greece, geographically connecting the hitherto known as disjunct northern and southern populations of this species, and clearly showing that the wing coloration exhibits a clinal variation from north to south, casting doubt about the validity of ssp. *coutsisi* Brown, 1977 (= *zagoriensis* Aussem, 1978). The generally held notion regarding Satyrinae, and as far as Europe is concerned, especially regarding the genera *Hipparchia*, *Pseudochazara* and *Hyponephele*, that the HW underside ground colour adapts to the geological character of the habitat by mimicking the colour of rock surfaces, is shown to be inapplicable both to *P. graeca*, as well as to *Hyponephele lycaon* (Rottemburg, 1775).

Samenvatting. Nieuwe gegevens betreffende de geografische verspreiding van *Pseudochazara graeca* in Griekenland, met bemerkingen over de kleur van de vleugels, de status van ssp. *coutsisi* (= *zagoriensis*) en de vermeende correlatie tussen de grondkleur van de onderkant van de achtervleugels en de geologische kenmerken van de habitat in zowel *P. graeca* als *Hyponephele lycaon* (Lepidoptera: Nymphalidae, Satyrinae)

Verscheidene kolonies van *Pseudochazara graeca* worden voor het eerst vermeld uit Noord-Centraal Griekenland, waardoor de noordelijke en zuidelijke populaties van deze soort, die tot nu toe bekend stonden als disjunct, geografisch met elkaar verbonden worden. Hierdoor wordt ook duidelijk dat de vleugelkleur een clinale variatie vertoont van noord naar zuid, waardoor de geldigheid van ssp. *coutsisi* Brown, 1977 (= *zagoriensis* Aussem, 1978) in vraag wordt gesteld. De algemene opvatting over de Satyrinae, en vooral over de Europese vertegenwoordigers van de genera *Hipparchia*, *Pseudochazara* en *Hyponephele*, dat de grondkleur op de onderkant van de achtervleugels aangepast zou zijn aan de geologische kenmerken van de lokaliteit, gaat niet op voor *P. graeca*, en evenmin voor *Hyponephele lycaon* (Rottemburg, 1775).

Résumé. De nouvelles données sur la répartition géographique de *Pseudochazara graeca* en Grèce, avec des remarques sur la couleur des ailes, le statut de la ssp. *coutsisi* (= *zagoriensis*), ainsi que sur la corrélation supposée entre la couleur du dessous des ailes postérieures et les caractéristiques géologiques de l'habitat des espèces *P. graeca* et *Hyponephele lycaon* (Lepidoptera: Nymphalidae, Satyrinae)

Plusieurs colonies de *Pseudochazara graeca* (Staudinger, 1870) sont mentionnées pour la première fois du centre-nord de la Grèce, ce qui connecte les populations septentrionales et méridionales de cette espèce que l'on croyait séparées antérieurement. Ces découvertes montrent aussi que la coloration des ailes montre une variation clinale du nord vers le sud, mettant ainsi en doute la validité de la ssp. *coutsisi* Brown, 1977 (= *zagoriensis* Aussem, 1978). La théorie selon laquelle la couleur du dessous des ailes postérieures des Satyrinae, et surtout des genres européens *Hipparchia*, *Pseudochazara* et *Hyponephele*, serait liée aux caractéristiques géologiques des biotopes, n'est pas applicable dans le cas de *P. graeca* et non plus pour *Hyponephele lycaon* (Rottemburg, 1775).

Key words: Nymphalidae - Saryrinae - *Pseudochazara graeca* - *P. graeca* ssp. *coutsisi* - *Hyponephele lycaon* - Greece - distribution - clinal colour variation - geology vs. wing underside ground colour.

Anastassiou, H. T.: 12 Periandrou Str., GR-15126 Athens (Marousi), Greece. hristosa@esd.ece.ntua.gr

Coutsis, J. G. : 4 Glykonos Street, GR-10675 Athens, Greece. kouts@otenet.gr

Ghavalas, N.: 30 Karaoli-Dimitriou Str., GR-12461 Athens (Haidari), Greece. vale98@otenet.gr

Introduction

The geographical distribution of *Pseudochazara graeca* (Staudinger, 1870) is characterized by the existence of several, relatively isolated colonies, occurring on numerous Greek mountains. Since the taxon's official elevation to species status by Brown (1976) [it was already treated as such in Higgins & Riley (1970), but without due explanation], no less than four additional subspecies have been described in literature: *coutsisi* Brown, 1977; *zagoriensis* Aussem, 1978; *apollo* Gross, 1978; *pelops* Gross, 1978. This classification was based on differences in wing colour and markings. Tolman & Lewington (1997) formally recognized only two distinct population entities, one consisting of colonies inhabiting southern and south-central Greece, namely the regions of Pelopónnisos and Stereá Ellás, and another inhabiting north-western Greece, i.e. Ípiros and southwestern Makedonía, and treated *coutsisi* as a form rather than a ssp. of *graeca*. An additional record (requiring confirmation) pertained to Mt. Ólimbos on the Makedonía/Thessalía border (Tolman & Lewington 1997). Finally, the species was also allegedly recorded from the Former Yugoslav Republic of Macedonia (F.Y.R.O.M.), in particular Mt. Pelister (Schaider & Jakšić 1988, Tolman & Lewington 1997, Lafranchis 2004), which is the northern extension of the Greek Mt. Varnús, where, however, its occurrence has never been ascertained, despite several searches by the authors.

Repeated attempts to discover additional colonies in north-central Greece (northern Stereá Ellás and Thessalía) had so far been unsuccessful, hence the two major populations were considered alienated from each other. On the basis of isolation and in conjunction with differences in wing coloration, both upper- and underside, it had been generally accepted that the taxon was represented by two different subspecies: the southern, light-colored, nominate ssp. *graeca* (Figs. 1, 2, 7, 8) and the northwestern, dark-colored ssp. *coutsisi* (= *zagoriensis*) (Figs. 5, 6, 11, 12). Brown (1977) emphasizes: "It remains unclear as to where the boundary between these two subspecies exists and its nature is entirely unknown". This issue remained unresolved for three decades. However, during an entomological expedition by the first author in the Ágrafa Mts and the southern Píndos mountain range (both in north-central Greece) in late July/early August 2008, and after a thorough and tedious search, six separate colonies were discovered, bridging over the geographical gap between the hitherto known two population distribution areas.

Moreover, the wing coloration of the specimens of the newly discovered colonies (Figs. 3, 4, 9, 10) was found to be intermediate between that of ssp. *graeca* and of ssp. *coutsisi*, clearly suggesting that a character cline is involved here, and that *coutsisi* cannot anymore be defined as a valid subspecies, but instead rather should be treated as an extreme form that has no taxonomic and nomenclatural significance. Further to this, a single male specimen (Figs. 13, 16) captured by the second author in "coutsisi" territory is colored in the *graeca* way, further suggesting that the former is but a colour form of the latter.

Hitherto known localities for *Pseudochazara graeca* from southern and south-central Greece

The southern and south-central colonies of *P. graeca* (henceforth referred to as the southern population) are very widely distributed, being found over almost all major mountains in the area (Fig. 19). Colonies have been recorded from Pelopónnisos, southern Greece (Mts. Taíyeto, Páron, Ménalo, Artemísio, Zíria, Helmós, Erímanthos, and Panahaikó), from Évvia island (Mt. Dírfis), and from Stereá Ellás, south-central Greece (Mts. Elikón, Íti, Parnassós, Gíona, Vardúsia, Timfristós, Kaliakúda, Oxiá, and Panetolikó).

Habitat

The butterfly is generally found on dry, rocky ground and at altitudes ranging from approximately 1600 to about 2000 m (Fig. 20). Sometimes it is also found in rocky clearings inside the upper altitudinal limit of coniferous forests.

Wing coloration in southern population

On the whole it may be said that the butterflies in this area are generally characterized by the light coloring of their wings both on upper- and underside (Figs. 1, 2, 7, 8). Of course, minor wing character variation does occur from mountain to mountain, but in our view this does not justify the naming of separate subspecies, for if indeed it does, then there should be a ssp. named for every single mountain in the area. Therefore the action taken by Gross (1978) in describing two new subspecies, namely *apollo* (TL Mt. Parnassós) and *pelops* (TL Mt. Ménalo) does not seem to us as being justifiable, and thus we are considering both names as being synonyms of *graeca*, agreeing at the same time with Tolman & Lewington (1997) who acted similarly.

Hitherto known localities for *Pseudochazara graeca* from north-western Greece

The north-western colonies of *P. graeca* (henceforth referred to as the northern population) are likewise scattered over several mountains, but rather in a more restricted way than are their southern counterparts (Fig. 19). The species has been recorded from Ípiros (Mts. Tzoumérka, Lákmos, Tímfi, Mitsikéli, Smólikas, and Katára Pass), as well as from Makedonía (Mt. Vasilítsa).



Figs. 1–6. *Pseudochazara graeca*, Greece, upperside. 1, 3, 5. ♂. 2, 4, 6. ♀. 1.– Stereá Ellás, Mt. Parnassós, 1800 m, 26.vii.1964; 2.– Évvía Island, Mt. Dírfis, 1200–1300 m, 5.viii.1979; 3.– Thessalía, Ágrafa Mts., Mt. Zigürolívado, 1650 m, 29.vii.2008; 4.– Thessalía, Ágrafa Mts., Mt. Karáva, 1750 m, 29.vii.2008; 5, 6.– Ípiros, Píndos Mts., Katára Pass, 1600 m, 17.viii.1976. Scale bar: 1 cm.



Figs. 7–12. *Pseudochazara graeca*, Greece, underside. 7, 9, 11. ♂. 8, 10, 12. ♀. 7.– Stereá Ellás, Mt. Parnassós, 1800 m, 26.vii.1964; 8.– Évvia Island, Mt. Dírfis, 1200–1300 m, 5.viii.1979. 9.– Thessalía, Ágrafa Mts., Mt. Zigurolívado, 1650 m, 29.vii.2008; 10.– Thessalía, Ágrafa Mts., Mt. Karáva, 1750 m, 29.vii.2008; 11, 12.– Ípiros, Píndos Mts., Katára Pass, 1600 m, 17.viii.1976. Scale bar: 1 cm.



Figs. 13–15. ♂, upperside, Greece. 13.– *Pseudochazara graeca* (light colored), Ípiros, Píndos Mts., Katára Pass, 1600 m, 8.viii.1974; 14, 15. *Hyponephele lycaon*. 14.– Pelopónnisos, Mt. Taíyetos, 1300 m, 9.vii.1998; 15.– Makedonía, Mt. Pangéo, 1500–1800 m, 6–7.viii.1979. Scale bar: 1 cm.



Figs. 16–18. ♂, underside, Greece. Same data as in figs 13–15. Scale bar: 1 cm.

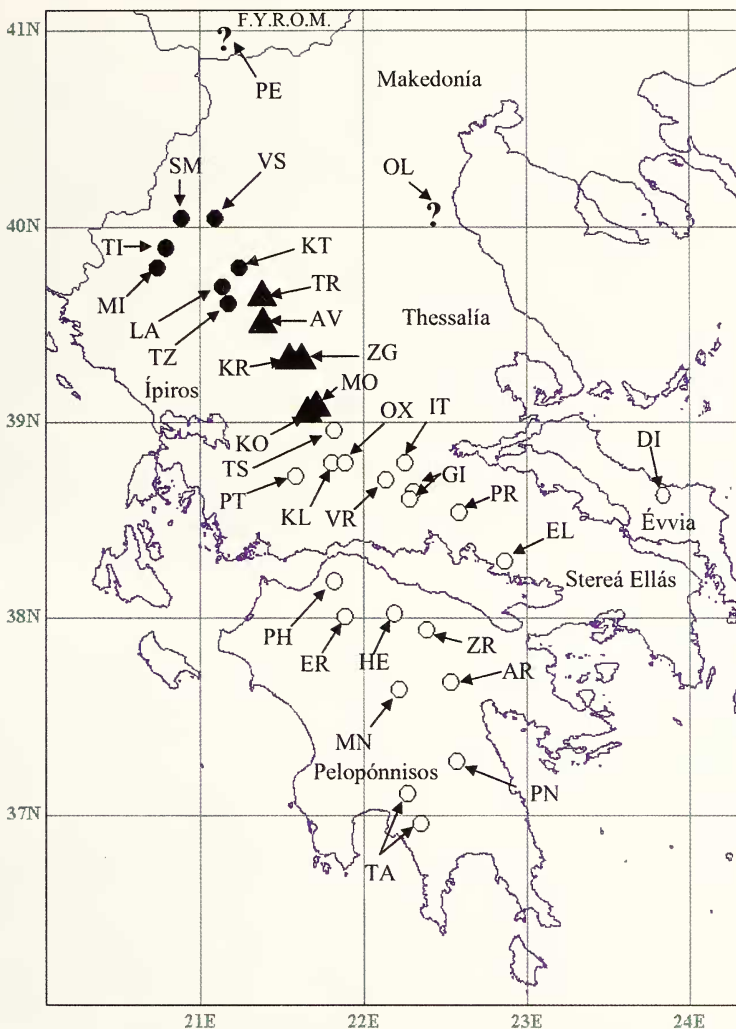


Fig. 19: Geographical distribution of *Pseudochazara graeca*. White circles: southern population. Black circles: northern population. Triangles: central population (new data). Map created with DMAP for Windows, version 7.2. (<http://www.dmap.co.uk>)

AR: Artemísio	KL: Kaliakúda	OL: Ólimbos	TA: Taíyetos
AV: Avgó	KO: Kópsi	OX: Oxiá	TI: Timfi
DI: Dírfis	KR: Karáva	PE: Pelister	TR: Tringía
EL: Elikón	KT: Katára Pass	PH: Panahaikó	TS: Timfristós
ER: Erímanthos	LA: Lákmos	PN: Pánon	TZ: Tzoumérka
GI: Gíona	MI: Mitsikéli	PR: Parnassós	VR: Vardúsia
HE: Helmós	MN: Ménalo	PT: Panetolikó	ZG: Zigurolivado
IT: Íti	MO: Morforráhi	SM: Smólikas	ZR: Ziria



Fig. 20. Typical habitat of *Pseudochazara graeca* in southern Greece (Mt. Taíyetos).



Fig. 21. Typical habitat of *Pseudochazara graeca* in north-western Greece (Mt. Lákmós).



Fig. 22. Typical habitat of *Pseudochazara graeca* in central Greece (Mt. Zigurolivado).

Habitat

Brown (1977) claimed that the butterfly "...flies over rough clearings in coniferous forests at altitudes of 1400 m to 1650 m. This is rather different from the habitat of *P. g. graeca*, which favours open scree slopes". In our opinion Brown's first paragraph holds true for both the northern and, as already stated, the southern population of *graeca*, provided the coniferous forest reaches its highest altitudinal limit, which is also the suitable altitude for *graeca*. Otherwise in almost all other instances, and for both the northern as well as the southern population, the butterfly is predominantly found on dry, rocky ground at altitudes ranging from about 1600 to about 2000 m (Fig. 21).

Wing coloration in northern population

The northern population butterflies are in general much darker than the southern ones, the darkest of all being found on Mts. Tímfi and Smólikas, i.e. at the northernmost limit of their range. Unh is typically dark reddish-brown, in contrast with the light greyish-brown hue of southern population specimens (Figs. 5, 6, 11, 12).

Mt. Ólimbos record

Specimens recorded from Mt. Ólimbos (Tolman & Lewington 1997), which is geographically detached from both aforementioned distribution areas (Fig. 19), are unknown to the authors and nothing can be said about their wing coloration, as there is no published information about it.

F.Y.R. of Macedonia record

Reported from Mt. Pelister by Schaidler & Jakšić (1988) (Fig. 19), but the figured specimens are from Katára Pass in northwestern Greece, and hence no conclusion can be drawn about the status of this, unconfirmed, population.

New records from north-central Greece

The by the first author recently discovered population of *Pseudochazara graeca* from north-central Greece (henceforth referred to as the central population) encompasses at least six colonies that are distributed both in the Ágrafa Mts (Morforráhi, Kópsi, Zigurolívado, Karáva), as well as in the Aspropótamos area of the south Píndos range (Avgó, Tringía) (Fig. 19).

Habitat

The typical habitat is, as for the northern and southern populations, dry, rocky ground, at altitudes ranging between 1600 and 1900 m (Fig. 22).

Wing coloration in central population

After an examination of a large number of set specimens, it was found that their coloration is, on average, intermediate, between that of the dark northern population and the light southern one (Figs. 3, 4, 9, 10).

Conclusions

In Fig. 19 it is clearly shown for the first time that the geographical distribution of *P. graeca* in Greece demonstrates no actual discontinuities, other than those caused by the lowlands, separating the hosting mountains. Uninterrupted distribution, along with clinal colour variation, sustained by the recently captured specimens in north-central Greece, implies that division of the taxon into two subspecies is inappropriate, and that the various wing colour schemes represent no more than forms.

Underside wing coloration versus geological character of habitat

It is generally accepted that the underside, cryptic coloration of butterflies habitually sitting on the ground, largely depends on the geological character of the habitat. In their discussion on *Pseudochazara graeca*, Tolman & Lewington (1997) claim: "Small but systematic local variation in size and coloration, esp. unh, appears to be due to ecological adaptation to the geological character of the habitat". Similar comments are found in Weiss (1980). Our experience with Greek mountains, however, does not necessarily support this assertion. The butterfly coloration (Figs. 7–12, 16) does not always follow the corresponding variation of the rock and soil hue above the tree line, in areas located within the range of *Pseudochazara graeca*. For instance, the environment on Mt. Zigurolívado (Fig. 22) is much more reddish-brown and darker than on Mt. Lákmos (Fig. 21), however, as discussed earlier, the coloration of the

corresponding butterfly populations follows the opposite trend (much darker and more reddish on Lákmos). Furthermore, the colour of the rocks on Mt. Taíyetos (Fig. 20), i.e. at the southernmost tip of the butterfly's range, is not appreciably different from that on Mt. Lákmos (Fig. 21), but the corresponding butterflies have a totally different underside; light and greyish on the former, dark and reddish-brown on the latter.

Similar observations have also been made by the authors for *Hyponephele lycaon* (Kühn, 1774). The population from Mt. Pangéo (north-eastern Greece) has a light bluish-grey HW underside (Fig. 18) while the one from Mt. Taíyetos has a dark brownish-grey one (Fig. 17), in spite of the fact that both mountains are characterized by their similar, whitish-grey limestone rocks.

Acknowledgement

The first author would like to thank Mr. Kyriakos Aptoglou for his assistance in translating articles written in French.

References

- Aussem, B. 1978. Beitrag zur systematischen Stellung von *Pseudochazara graeca* und Beschreibung einer neuen Subspecies (Lep., Satyridae). — *Entomologische Zeitschrift*, Frankfurt-am-Main **88**: 13–22.
- Brown, J. 1976. A review of the genus *Pseudochazara* de Lesse 1951 (Lep.: Satyridae) in Greece. — *Entomologist's Gazette* **27**: 85–90.
- Brown, J. 1977. A new subspecies of *Pseudochazara graeca* (Staudinger, 1870) (Lep.: Satyridae) from Greece. — *Entomologist's Record and Journal of Variation* **89**: 68–69.
- Gross, F. J. 1978. Beitrag zur Systematik von *Pseudochazara*-Arten (Lep. Satyridae). — *Atalanta*, Münsterstadt **9**: 41–103.
- Higgins, L. G. & Riley, N. D. 1984. A Field Guide to the Butterflies of Britain and Europe. — Collins, London. 384 pp.
- Lafranchis, T. 2004. *Butterflies of Europe*. — Diatheo, Paris. 351pp.
- Schaider P. & Jakšić, P., 1988. *Die Tagfalter von jugoslawisch Mazedonien*. — Schaider, München. 199 pp.
- Tolman, T. & Lewington, R. 1997. *Butterflies of Britain and Europe*. — Collins, London. 320 pp.
- Weiss, J. C. 1980. Le genre *Pseudochazara* de Lesse en Europe et en Afrique du Nord. Description d'une sous-espèce nouvelle de *Ps. hippolyte* Esper (Lep.: Satyridae). — *Linneana Belgica* **VIII**(3): 98–108.
-